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MOISTURE CONTENT IN TEA

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As in most natural organic material, moisture in tea is an important constituent that influences the physical, chemical, electrical and other properties.

Moisture could exist in a mixture with other materials as a solid, a liquid, a vapour or as chemically bound water. True evaluation of the water-related behaviour characteristics of a material would require an adequate knowledge of the concentration of all the components of the material, their individual moisture characteristics and the concentration of the water, not in a total water quantity concept but, in each of its possible forms.

Fortunately, the moisture condition of tea can generally be equated (Thevathasan and Samaraweera, 1985) to the net effect of the water in terms of its water vapour pressure, expressed as water activity.

Tea deteriorates faster when the moisture content is high. Moisture content/water activity exerts a decisive influence on such phenomena as change in colour, taste and aroma, food poisoning and spoilage, loss of

vitamins, etc. But the total moisture content has very little to do with this.

Water activity indicates the amount of water in a total water content which is available to micro-organisms (bacteria, yeasts and moulds). Each species of micro-organism has its own minimum water activity value below which growth is no longer possible. This corresponds to the "suction power" of the various organisms, i.e. the osmotic pressure which they create can be higher than that in the aqueous phase of food to absorb from the food the water needed for metabolic activity and growth. By measuring the water activity value of food stuffs it is possible to determine which micro-organisms will not be able to develop on them.

Food stability water activity relationships worked out by Lubuza (1970) indicate that growth of moulds, yeasts and bacteria are inhibited at water activity levels below 0.70. It is also known that water activity levels of over 0.8 or so promotes the rapid growth of micro-organisms (de Man, 1976).

Water activity in tea can be controlled by using satisfactory packing materials, by maintaining favourable conditions in storage etc. provided the teas are correctly dried.

It was established that the water activity can be related to the moisture content of tea (Thevathasan and Samaraweera, 1985). It was also found that the water activity is independant of the particle size of tea (Thevathasan and Samaraweera, 1989) and only depends on the moisture content.

Water activity of tea dhools during drying operation was studied in relation to the moisture content (dry basis) and was found to represent a Henderson equation (Thevathasan and Samaraweera, 1985). But in tea industry the moisture content in tea is generally expressed on a wet basis. The estimated moisture content on wet basis and the corresponding water activity in tea dhools from a derived Henderson equation are tabulated below:

Moisture content (%) (Wet basis)		Water activity (%)
1.3	.....	0.01
2.2	.....	0.05
3.0	.....	0.08
4.8	.....	0.22
6.4	.....	0.43
8.3	.....	0.65
9.8	.....	0.70
11.0	.....	0.75
13.0	.....	0.80
17.5	.....	0.88
22.5	.....	0.93

As mentioned earlier, growth of moulds, yeasts and bacteria can take place in tea at a water activity level of 0.70 which corresponds to a moisture content (wet basis) in tea of 9.8. If the moisture content is above 13.0% corresponding to a water activity of 0.8 micro-organisms can rapidly grow in tea. The maximum permitted level of moisture in tea should therefore be less than around 10%.

On the above basis the maximum permissible level for tea at the time of packing in chests can be safely considered to be 6%. The moisture levels of teas packed in

chests depend on:

i. moisture level of tea at dryer mouth,
ii. moisture absorption during grading, in bins and during packing and
iii. moisture absorption after packing in chests.

The expected moisture levels of tea at drier mouth is 3.0%. Moisture absorption during grading, in bins and during packing can be in the region of 1.5 - 2.5%. Moisture absorption after packing in chests is generally less than 1.0% over a period of 2 months. This means that if tea is properly dried to a level of 3.0% one could allow a maximum of 2.0% absorption prior to packing and a 1.0% absorption after packing in order to be within 6.0% at the time of sale.

Some surveys carried out in mid-country and up-country average factories indicate that the,

i. moisture levels of drier mouth teas are mostly in the region of 2.0 - 4.0%,
ii. moisture levels of tea at the time of packing main grades are 3.5 - 6.5% and
iii. moisture absorption after packing in chests is less than 1% over a period of 2 months.

However, this is not practised in the low-country. Some observations made indicate that,

i. moisture levels of drier mouth teas are in the region of 1.3 - 7.5%. This very erratic firing is completely unsatisfactory,

ii. moisture levels of tea at the time of packing are in the region of 4.0 - 12.0%. This is extremely unsatisfactory and

iii. moisture absorption after packing in tea chests is less than 1%.

This means that once the drying stage has been neglected the only course of action left in order to maintain the requisite moisture standard in packed teas, is refiring.

In conclusion to meet the above demands the following corrective measures are recommended to maintain the moisture level of 6.0% at the time of sale :

1. Create awareness of the problem. In Up and Mid elevation, factory personnel and Superintendents are conscious of the problem and they generally make an attempt to do proper drying, organise sorting and storage in bins and packing to minimise absorption of moisture. In low country these aspects are not given due consideration. This must change. Where necessary refiring must be carried out.

2. Carry out moisture measurements as a daily routine quality control activity. Provide moisture measuring equipment if not available.

3. Better organization of sorting process. Minimise delays in grading. Cut down the number of grades whenever possible. That is because if the percentage of a grade is 1.0%, it takes 20 days for a factory with an intake of 10,000 kg green leaf to make a break of 10 chests.

4. Use colour separators for the cleaning of leafy grades at least in large factories. This minimizes delays in sorting from typical 7 - 10 days to 1 - 2 days and thus minimize absorption of moisture.

REFERENCES

De MAN, J.M. (1976). Principles of Food Chemistry. The Avi Publishing Company, Inc. Westport. 25 - 32.

THEVATHASAN, A. and SAMARAWEERA, D.S.A. (1985). Water activity in tea. *S. L. J. Tea Sci.* **54** (2), 78 - 83.

THEVATHASAN, A. and SAMARAWEERA, D.S.A. (1989). Water activity in relation to the size of black tea particles. *S. L. J. Tea Sci.* **58** (2), 87 - 91.

LUBUZA, T.P.(1970). *Proc. 3rd Int. Conf. Food Sci. Technol,* Washington, p.618.